Maryland Historical Trust
Maryland Inventory of
Historic Properties Form

Inventory No. M: 29-52-9

1. Name of Property (indicate preferred name)

historic: Maneuvering and Seakeeping Facility

other: Building 18

2. Location

street and number: Naval Surface Warfare Center Carderock Division, 9500 MacArthur Boulevard ___ not for publication

city, town: West Bethesda ___ vicinity

county: Montgomery

3. Owner of Property (give names and mailing addresses of all owners)

name: United States Navy

street and number: 9500 MacArthur Boulevard telephone

city, town: West Bethesda state: MD zip code: 20817-5700

4. Location of Legal Description

courthouse, registry of deeds, etc.: Montgomery County Courthouse liber: folio:

city, town: Rockville tax map: tax parcel: tax ID number:

5. Primary Location of Additional Data

___x___ Contributing Resource in National Register District
_____ Contributing Resource in Local Historic District
_____ Determined Eligible for the National Register/Maryland Register
_____ Determined Ineligible for the National Register/Maryland Register
_____ Recorded by HABS/HAER
_____ Historic Structure Report or Research Report at MHT
_____ Other: NSWC Carderock

6. Classification

Category
_____district
__x__building(s)
_____structure
_____site
__X__object

Ownership
__X__public
_____private
_____both

Current Function
_____agriculture
_____commerce/trade
__X__defense
_____domestic
_____education
_____funerary
_____government
_____health care
_____industry
_____landscape
_____recreation/culture
_____religion
_____social
_____transportation
_____work in progress
_____unknown
_____vacant/not in use
_____other:

Resource Count

Contributing	Noncontributing
1	_____ buildings
_____	_____ sites
2	_____ structures
_____	_____ objects
3	_____ Total

Number of Contributing Resources previously listed in the Inventory
0

7. Description

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Condition

___x excellent	___ deteriorated
___ good	___ ruins
___ fair	___ altered

Prepare both a one paragraph summary and a comprehensive description of the resource and its various elements as it exists today.

Summary Statement: The Maneuvering and Seakeeping (MASK) facility consists of two large test basins enclosed within Building 18 at the Naval Surface Warfare Center, Carderock Division. The MASK facility occupies a location at the far west end of the 186-acre installation, largely separated from other buildings by a wooded area. Located approximately 12 miles northwest of Washington, D.C., near Bethesda, Maryland, NSWCCD is situated north of the Potomac River and is bordered by the Clara Barton Parkway to the south and MacArthur Boulevard to the north and east. The installation today has over 100 buildings and structures that function as research laboratories, administration facilities, and operations and utility structures. At the center of the installation is the David Taylor Model Basin (Buildings 1-4) a group of interconnected buildings that include a model basin, administration building, a shop building and laboratory. The David Taylor Model Basin was listed on the NRHP in 1985. In 1996 the NSWCCD Historic District was determined eligible for the NRHP, and forty-four buildings and structures were recognized as contributing resources in the district.

The Maneuvering and Seakeeping Facility

The term "maneuvering and seakeeping" applies specifically to the rectangular western basin, which is basically an "instant ocean" for testing models in water disturbed by artificially-created waves and wind. The other facility is basically a very large, circular turning basin, known as the Rotating Arm Basin, in which models attached to a carriage beneath a bridge-like rotating "arm" are towed through still water.

The reinforced concrete circular turning basin is 260 feet in diameter and 21 feet deep. A concrete pedestal at the center of the basin carries a roller bearing assembly on which one end of the rotating arm -- a 129-foot structure resembling a truss bridge formed with aluminum tubing -- pivots. The outboard end of the arm rides on two 30-inch-diameter wheels (which drive the structure) set on a rail on top of the basin wall. These drive wheels are directly coupled through a 12-foot shaft to electric motors capable of powering the arm up to a speed of 30 knots in one-half revolution, and of up to 50 knots with slightly more than one full turn.

Struts connected to the towing carriage mounted beneath the truss arm position the submerged models in yaw, roll and pitch; they are remotely controlled from a station on the center pedestal.

An observation room is located on the west side of the basin, from which the movement of the models can be viewed during tests.

Much of the limited floor area between the Rotating Arm Basin and the Maneuvering Basin is informally subdivided into shop areas, many devoted to the making or equipping of models, with plywood or metal partitions.

The Maneuvering and Seakeeping Basin is 360 feet long, 240 feet wide, and 20 feet deep except for a 35-foot-deep, 50-foot-long trench along the south side for testing free-running models. Sloping grids running the full length of the east and south sides of the basin, known as "beaches", absorb the waves produced by the wavemakers positioned along the opposite (west and north) sides.

The 376-foot steel maneuvering bridge, which spans the full length of the MASK basin, weighs approximately 230 tons, is 20 feet wide, and has a maximum truss depth at midspan of 35 feet. Fitted with a trolley under each corner, the bridge moves on a rail system up to half the width of the basin (120 feet), and can rotate up to 45 degrees when positioned at the center of the basin. A towing carriage of welded aluminum tubes runs along tracks on the underside of the bridge deck, supported by four support trolleys.

The wavemaker system at the MASK consists of 21partially-submerged domes, eight at the west end of the basin and 13 arranged along the north side. Motor-driven blowers located in the blower equipment room above the wavemaker control platform on the north side of the basin produce alternating positive and negative air pressure to create waves of varying amplitude.

An observation room is located beneath the beach on the south side of the basin, from which the submerged models can be viewed during tests.

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Building 18, the enclosure for these test facilities, is 695 feet long (west to east) and about 280 feet wide. The continuous steel arch building sits on a reinforced concrete foundation founded on rock. The reinforced concrete extends up the exterior walls at least three feet above grade. Reinforced concrete buttresses support each of the 8-foot-deep steel arches, set with the exception of the two end wall arches on 29-foot centers, that rise to a maximum height of nearly 80 feet above grade. The roof is clad with corrugated metal sheets, as are the west and east end walls.

At the west end of the north elevation and near the center of the south elevation are shed-roofed concrete-walled projections 89 feet long and about 28 feet deep, each enclosing a staircase and accommodating the ends of the maneuvering bridge at the full extent of its 45-degree rotation. These are original to the facility, as is a similar projection toward the east end of the north elevation which encloses the formal entrance to the facility, toilets and a locker room. The formal entrance pavilion features twelve tall, narrow bays infilled with glass block. A canopy roof bearing the formal name of the facility ("Harold E. Saunders Maneuvering and Seakeeping Facilities") projects from the lower portion of the westernmost three bays to shelter the doorway. Over the decades, the Navy has built three Dryvit-clad, flat-roofed additions to the north side, primarily for office space. Across the base of the west elevation are seven regularly-spaced concrete projections with louvred openings providing pressure relief for the Maneuvering Basin's wavemaker blowers.

8. Significance

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Period	Areas of Significance	Check and justify below		
__ 1600-1699	__ agriculture	__ economics	__ health/medicine	__ performing arts
__ 1700-1799	__ archeology	__ education	__ industry	__ philosophy
__ 1800-1899	__ architecture	__ engineering	__ invention	__ politics/government
X 1900-1999	__ art	__ entertainment/ recreation	__ landscape architecture	__ religion
__ 2000-	__ commerce		__ law	__ science
	__ communications	__ ethnic heritage	__ literature	__ social history
	__ community planning	__ exploration/ settlement	__ maritime history	__ transportation
	__ conservation		X military	__ other: ____

Specific dates 1955-61 **Architect/Builder** U. S. Navy, Bureau of Yards and Docks

Construction dates 1955-1962 Sverdrup & Parcel, Consulting Engineers

Evaluation for:

_____X_____ National Register _____Maryland Register _____not evaluated

Prepare a one-paragraph summary statement of significance addressing applicable criteria, followed by a narrative discussion of the history of the resource and its context. (For compliance projects, complete evaluation on a DOE Form – see manual.)

Summary

The Maneuvering and Seakeeping Facility at Naval Surface Warfare Center, Carderock Division, contributes to the significance of the NSWCCD Historic District. It meets National Register Criterion A for its direct and important association with the hydromechanics research, development, testing and evaluation programs established here with the opening of the David Taylor Model Basin in 1940 and expanded during the first two decades of the Cold War era (c. 1950-1970). The MASK also meets National Register Criterion C as an essentially unaltered facility designed for maneuvering tests and tests requiring high water speed (the Rotating Arm Basin), and for conducting tests in waves. The MASK basin, in particular, is noteworthy as the largest of its kind in the world and for its then-unique ability to generate the highly complex wave patterns characteristic of open sea. Both the Rotating Arm Basin and the MASK facility possess integrity of design, workmanship, and materials, are in their original location, and maintain through their continued operation the integrity of their historical associations with the overall mission of NSWCCD. Operational controls have been upgraded and augmented continuously over the decades, beginning soon after the facility was placed in service, in order to improve or enhance capabilities. Building 18, although notable for its size, does not exhibit any unusual or notable characteristics of design or construction, its continuous arch form being not unlike that of an airplane hangar requiring very large clear spans and interior height. Additions on the north side of Building 18 have not altered any of the characteristics that contribute to the MASK facility's significance.

The Harold E. Saunders Maneuvering and Seakeeping Facility[1]

When it became fully operative in 1940, the David Taylor Model Basin had four basins. The deep-water, shallow-water and high-speed basins were located in Building 1, the "small basin" in the basement of Building 3. Only the latter was equipped with a wavemaker, although the wavemaker at the Experimental Model Basin at the Washington Navy Yard was also available for tests. The only facility for maneuvering tests was a relatively small, J-shaped section at the west end of the shallow-water basin.

Within a few years after the DTMB became operational, the installation's Hydromechanics Laboratory concluded that these existing facilities were inadequate for testing in waves, maneuvering tests, and tests requiring high water speed. The Laboratory therefore began initial plans for a large maneuvering basin, equipped with wavemaking systems, and an outdoor (unenclosed) rotating arm basin in 1942. However, when it became evident that neither basin could be built nor made operational quickly enough to meet the Navy's immediate wartime needs, the plans were put aside.

After the war, planning resumed, and on a more ambitious scale. The rotating arm basin was now to be enclosed within the same building as the maneuvering basin. The latter was to be equipped with wavemakers on two sides (rather than on just one side as had

[1] The principal sources of information for this section are Brownell (1962), Anonymous (1964), drawings of the MASK Facility on file at the NSWCCD Public Works Department.

heretofore been the practice), and waves would be produced by air pressure rather than mechanically. Functional specifications for these two facilities were completed in 1952, and their soundness verified by construction and extensive testing of a 1/10-scale model. With multi-year funding from the Navy Public Works program, construction began in 1956 from engineering plan and specifications administered by the Bureau of Yards and Docks, Area Public Works Office, Potomac River Naval Command and prepared by Sverdrup and Parcel, Consulting Engineers with assistance from the Hydromechanics Laboratory. The MASK was ready for calibration and use in 1961.

Together the two basins "proved to be a facility of great flexibility in which a multitude of investigations [could] be carried out" beyond the purposes for which they were designed (Brownell 1962: 13). The large dimensions of the Rotating Arm Basin made it possible to tow submarine models of up to 20 feet in length, and surface ship models up to 30 feet long – at speeds up to 50 knots if required. While the testing of models in waves dated back to the late 19th century, and wavemaking capacity was common to most model basins, waves had heretofore been produced from but one side of a basin by wavemakers in synchrony, resulting in long-crested, regular waves not customarily encountered on the ocean. The Maneuvering Basin's ability to generate complex, irregular wave patterns like those produced at sea through the use of multiple wavemakers capable of operating independent of one another (e.g. with constant or variable frequency, or out of phase with each other) was a unique feature that enormously enhanced the verisimilitude of the environment in which models were tested – and thereby the quality of the test results.

Historic Context

The U. S. Navy's first laboratory for studying ship behavior was the United States Experimental Basin (Model). Constructed in 1898 under the leadership of Rear Admiral David Watson Taylor, the EMB was located at the Washington Navy Yard. Designed for the testing of ship hulls, propeller studies, and rudder developments, the basin contained a carriage that towed wooden shop models and carried cameras to allow engineers to study how eddy and wave making resistance were generated (Melhuish 1996). In 1912, due to advancements in aviation, the Navy expanded its laboratory facilities to include a wind tunnel. Designed by aeronautical engineers, Holden C. Richardson and William W. McEntree, the Navy's first wind tunnel was completed in 1913 and was used to test the resistance of shapes in air to improve the aerodynamics of airfoils, body shapes, and windshield design (Carlisle 1998: 78).

The facilities at the Washington Navy Yard soon proved inadequate. The basin was resting on an unsteady foundation undermined by springs, and it had become technically insufficient to meet the demands of both commercial users and the rapidly modernizing Navy (Carlisle 1998: 132). In 1936 Congress authorized funding for the construction of a new basin, and in 1937, 107 acres in Carderock, Maryland was chosen for the new installation due to the presence of bedrock, level terrain, nearby water supply, and accessibility to downtown Washington (Carlisle 1998: 144). Construction at Carderock began in 1937, and the official dedication was held on November 4, 1939 for the David Taylor Model Basin, named in honor of David W. Taylor.

The primary mission of the DTMB, as defined by Congress, was to investigate and determine the most suitable and desirable shapes and forms for naval vessels and aircraft (Melhuish 1996). During its first year of operation, the DTMB was mostly involved in design work, but at the outset of World War II, activities at the DTMB were focused on war-related topics. Research became a major directive, and new facilities and staff were added to support research activities. New facilities added to installation included a research pit for explosion testing (1941), wind tunnels and associated buildings (1942), a pentagonal test pond to test under water explosives (1943), Circulating Water Channel to test the angles and drag of underwater towed devices (1944), and two supersonic wind tunnels that had been dismantled in Germany and installed at Carderock (1946) (Melhuish 1996).

The "Golden Age of Research" at Carderock (c. 1950-1970)

Expansion of the aerodynamics facilities at Carderock after World War II coincided with a "drastic realignment" of mission that inaugurated a "Golden Age of Research" for DTMB (McCarthy 1993: 30, 34). Over this period (1950-1970) DTMB was able to expand its hydrodynamics facilities to include elements planned but not built during the war, and to bring on board the new technology of electronic computing, which thereby added numerics to the formidable analytical and experimental capabilities already present. The Structural Mechanics department obtained a large new facility, and acoustics became an important new area of inquiry.

The Applied Mathematics Department was established in 1952, originally (1953) equipped with a Universal Automatic Computer (UNIVAC-A). The Livermore Atomic Computer (LARC) was added in 1960 (Melhuish 1996). The Applied Mathematics Department was actively involved in the Navy's nuclear research program, providing mathematical predictions of the core life of submarine nuclear reactors to accurately project refueling requirements. This department also provided important support to the Hydromechanics and Structural laboratories by developing "numerical solutions to...complex problems of computational fluid and structural mechanics" (Carlisle 1998: 224). By the late 1950s the computer laboratory was performing horsepower calculations, performing propeller studies, and predicting blast effects on ship hulls and effects of vibration on structures. In 1959, DTMB's mission was modified to include high speed computer services to the Bureau of Ships, its laboratories, and its shipyards (Melhuish 1996).

Within two short years after the model testing facilities at DTMB became fully operational (1940), scientists and engineers saw the need for additional facilities, specifically a water tunnel larger than the existing 12" and 24" tunnels (which did not provide sufficient capacity for propeller cavitation experiments) and a basin sufficiently large and well-equipped to conduct maneuvering tests, test in waves and tests requiring high water speed. Planning for both water tunnel and maneuvering basin was begun in 1942. However, when it became apparent that neither facility could be completed and activated fast enough to meet the urgent needs of wartime, these plans were suspended (Brownell 1962: 1). After the war, planning resumed, and with multi-year funding from the Navy Public Works program, construction began on a new 36" water tunnel in 1955, and on a maneuvering basin and a large rotating arm basin (under one roof and called the Maneuvering and Seakeeping (MASK) facility in 1956. The MASK facility was ready for calibration and use in 1961, the water tunnel the following year (Brownell 1962: 2-3).

1963 saw the establishment of another new department, the Acoustics and Vibration Laboratory, which brought together scientists and engineers from several other departments to play a lead Navy role in measurement and diagnosis of full-scale radiated noise signatures from ships and submarines – an area of inquiry of paramount importance to the Navy's submarine warfare programs (McCarthy 1993: 32). Four years later, the Structural Mechanics department obtained a major new facility featuring five high-pressure deep submergence tanks for testing the hulls of underwater vehicles and a test bed for stressing large model ship structures under loads up to 250,000 lb. (McCarthy 1993: 33). By 1970, the acoustics department had significantly expanded its capabilities with the addition of acoustic ranges off Washington and California, plus, at Carderock, completion of an Anechoic Data Analysis Center and an anechoic flow facility consisting of a subsonic wind tunnel equipped with an anechoic chamber (McCarthy 1993: 32-33) That same year the Systems Development Department was created "with the intention of providing a total ship systems, hardware-oriented focus" (McCarthy 1993: 36).

On 31 March 1967, the Marine Engineering Laboratory at Annapolis and the Carderock facilities were merged to form the David Taylor Naval Ship Research and Development Center. However, the "Golden Age" of research at DTMB came to an end in the 1970s, as funding declined and staff were reduced from 3122 to 2482 – totaling a loss of 640 by 1980 (McCarthy 1993: 33). When funding resumed under the Reagan administration, it was on a very different basis, as most of the Center's annual budget was contracted to private industry. The Center was increasingly involved in both design and hardware demonstration phases of vehicle

development, and there was much less support for "fundamental research, exploratory development, and advanced development investigations" (McCarthy 1993: 37, 40).

Period of Significance for the NSWCCD Historic District

The 1996 survey of NSWCCD proposed a period of significance for the NSWCCD Historic District beginning in 1938 and ending in 1958. The MHT Historic Sites form for the district justifies the end date of 1958 with the statement that "this year [e.g. 1958] marks the end date for the construction of physical model testing and research facilities and marks the introduction of computer aided research, design, testing and evaluation program". Research conducted in 2005, in association with evaluation of the 36" VPWT indicates that, to the contrary, two important model testing facilities originally planned during World War II (one of them being the 36" VPWT), were under construction in 1958 and would be completed within the next few years. Furthermore, although the Center's mission was "formally expanded [in 1958] to include computers and computer services in the development of naval vehicles" such capabilities had been employed at Carderock since installation of the UNIVAC-A at the Applied Mathematics Laboratory in 1953. The 1993 article "David Taylor Research Center" by Justin McCarthy, then head of the Naval Hydromechanics Division at Carderock, offers persuasive evidence that the introduction of computers did not eclipse the model testing programs, and that there was indeed a two-decade "Golden Age" of well-funded, innovative research fueled by the Navy's prosecution of the Cold War both in the laboratory and at sea. As a result, the period of significance for the NSWCCD may reasonably be extended to 1970; thereafter the Center experienced substantial funding and staffing cuts, followed by new emphasis on applications for private industry and significantly less support for "fundamental research and exploratory development".

9. Major Bibliographical References

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See Continuation Sheet.

10. Geographical Data

Acreage of surveyed property	approximately 1 acre		
Acreage of historical setting	186 acres		
Quadrangle name	Falls Church	Quadrangle scale:	1:24000

Verbal boundary description and justification

The boundary of the of resource coincides with the footprint of Building 18 at the Naval Surface Warfare Center, Carderock Division.

11. Form Prepared by

name/title	M.H. Bowers		
organization	The Louis Berger Group, Inc.	date	November 2005
street & number	75 Second Ave.	telephone	617 444 3330
city or town	Needham	state	Mass 02494

The Maryland Inventory of Historic Properties was officially created by an Act of the Maryland Legislature to be found in the Annotated Code of Maryland, Article 41, Section 181 KA, 1974 supplement.

The survey and inventory are being prepared for information and record purposes only and do not constitute any infringement of individual property rights.

return to: Maryland Historical Trust
DHCD/DHCP
100 Community Place
Crownsville, MD 21032-2023
410-514-7600

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Anonymous
1964 Research Facilities at the David Taylor Model Basin. Department of the Navy, David Taylor Model Basin, Hydromechanics Laboratory Research and Development Report No. 1913.

[c. 1953] Special and Unique Facilities of U.S. Naval Research and Development Facilities. Department of the Navy, NAVEXOS P-1359.

Brownell, W.F.
1962 Two New Hydromechanics Research Facilities at the David Taylor Model Basin. Department of the Navy, David Taylor Model Basin, Hydromechanics Laboratory Research and Development Report No. 1690.

Carlisle, Rodney P.
1998 Where the Fleet Begins: A History of the David Taylor Research Center 1898-1998. Department of the Navy, Naval Historical Center, Washington DC.

David Taylor Naval Surface Research and Development Center
1981 FY 1981-86 Technical Facilities Maintenance Study. Prepared by Director, Plans and Programs, Resources Planning Office, David Taylor Naval Surface Research and Development Center, Carderock, Maryland.

McCarthy, Justin H.
1993 "David Taylor Research Center", in H. Benford and W.A. Fox, editors, A Half-Century of Marine Technology, 1943-1993. Society of North American Mechanical? Engineers, Jersey City, New Jersey.

Melhuish, Geoffrey E.
1996 *Historical and Architectural Documentation of the Naval Surface Warfare Center Carderock Division, Maryland: Draft.* Prepared by R. Christopher Goodwin and Associates, Inc. for Engineering Field Activity-Chesapeake, Washington, D.C.

US Department of the Navy
1956 "David W. Taylor Model Basin, Rotating Arm and Maneuvering Basin". Set of drawings generated by the Bureau of Yards and Docks District Public Works Office, Potomac River Naval Command, Washington, D.C., with Sverdrup & Parcel, Inc., Consulting Engineers. On file at Public Works Department, NSWCCD.

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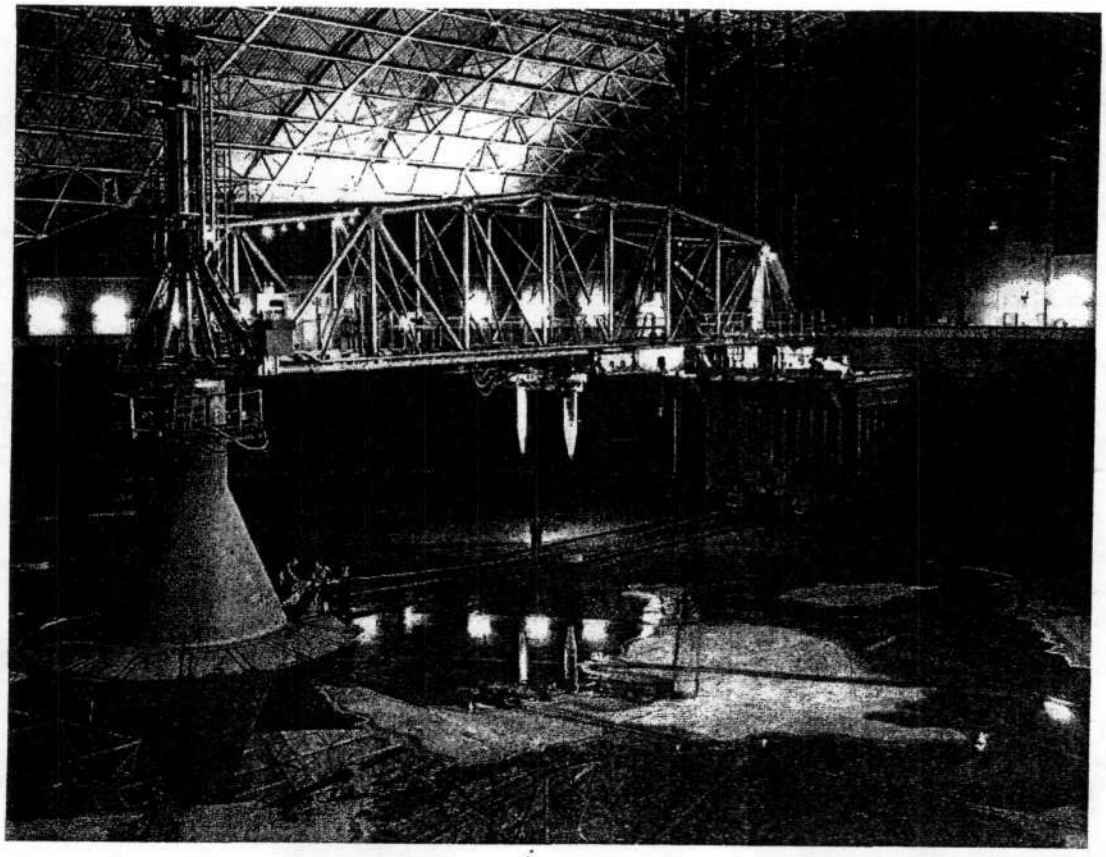

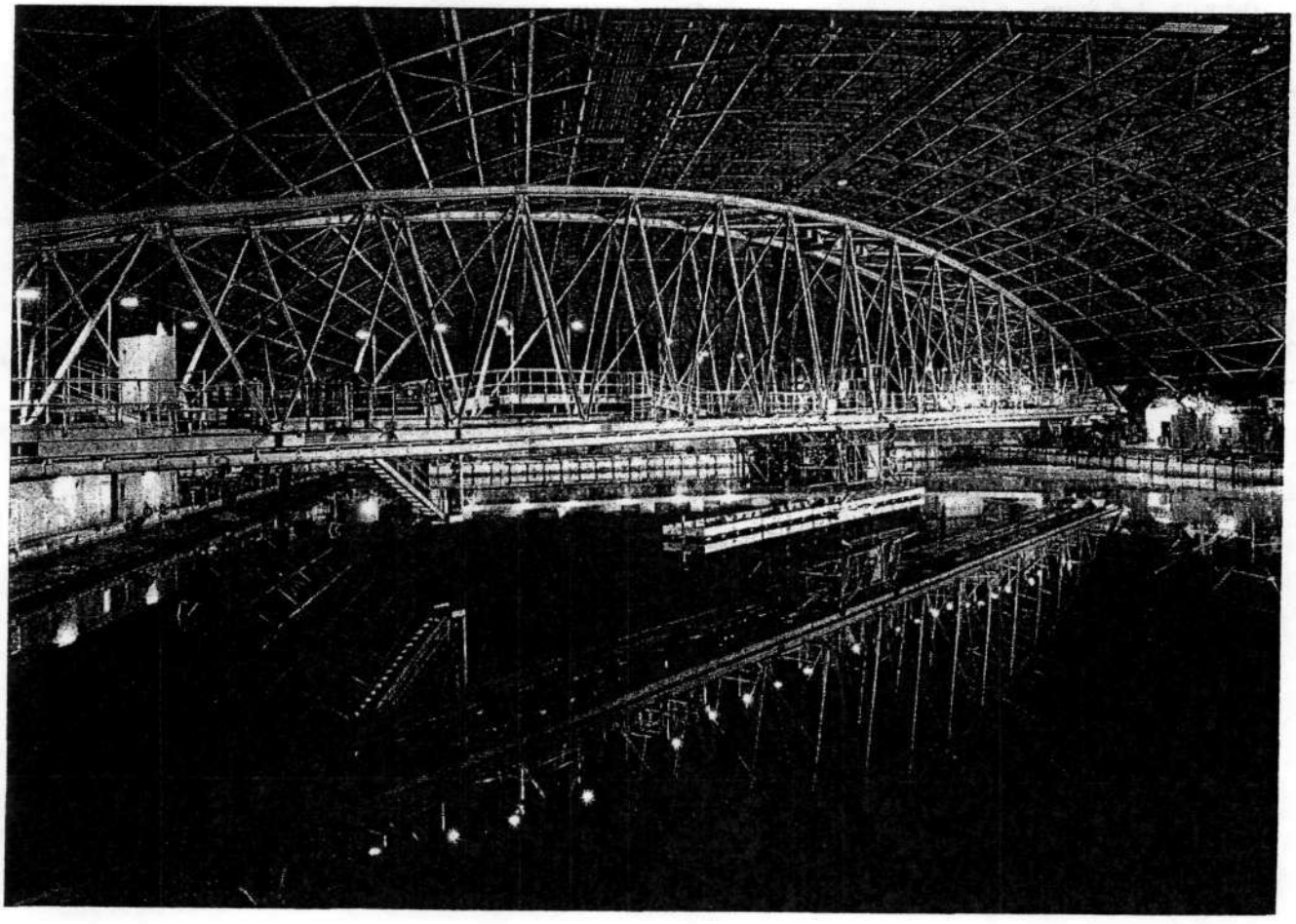

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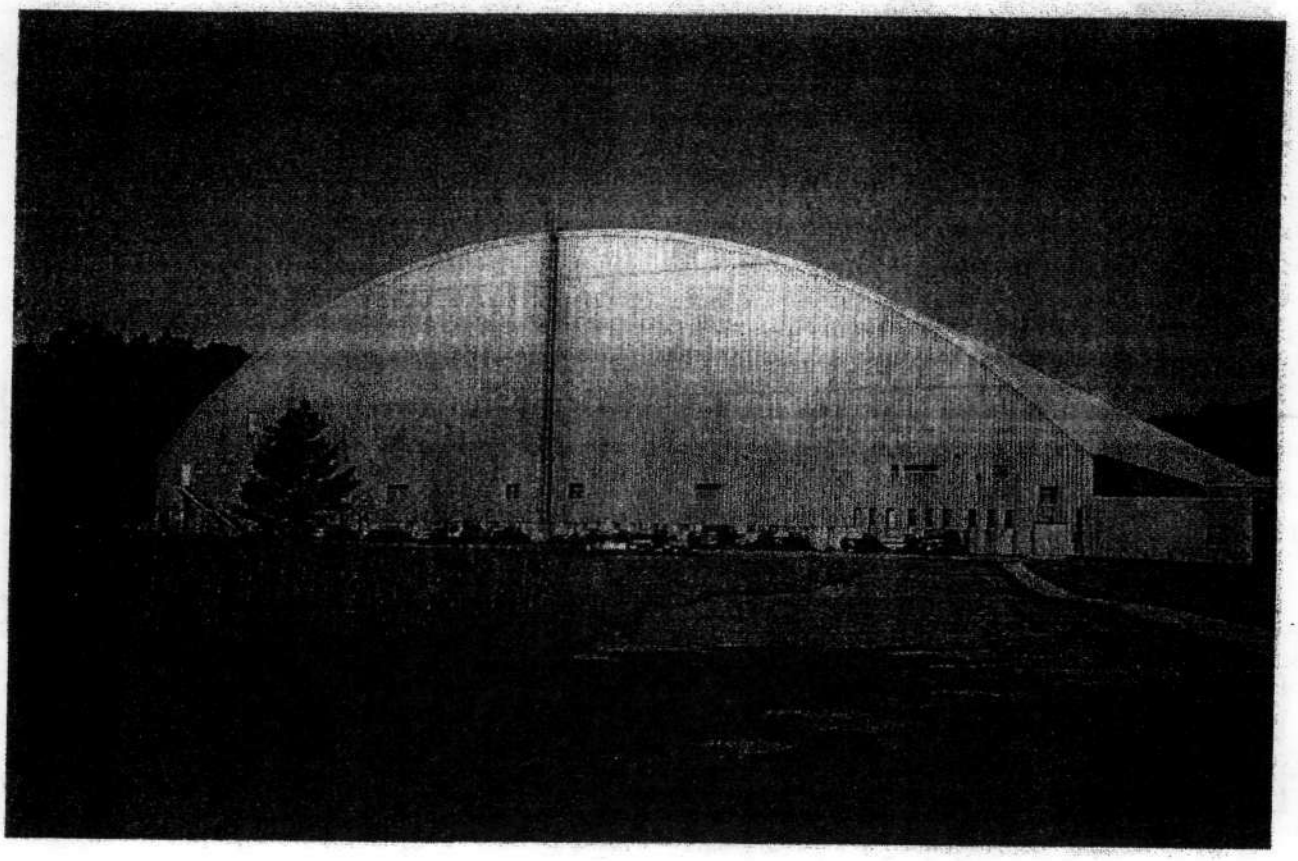

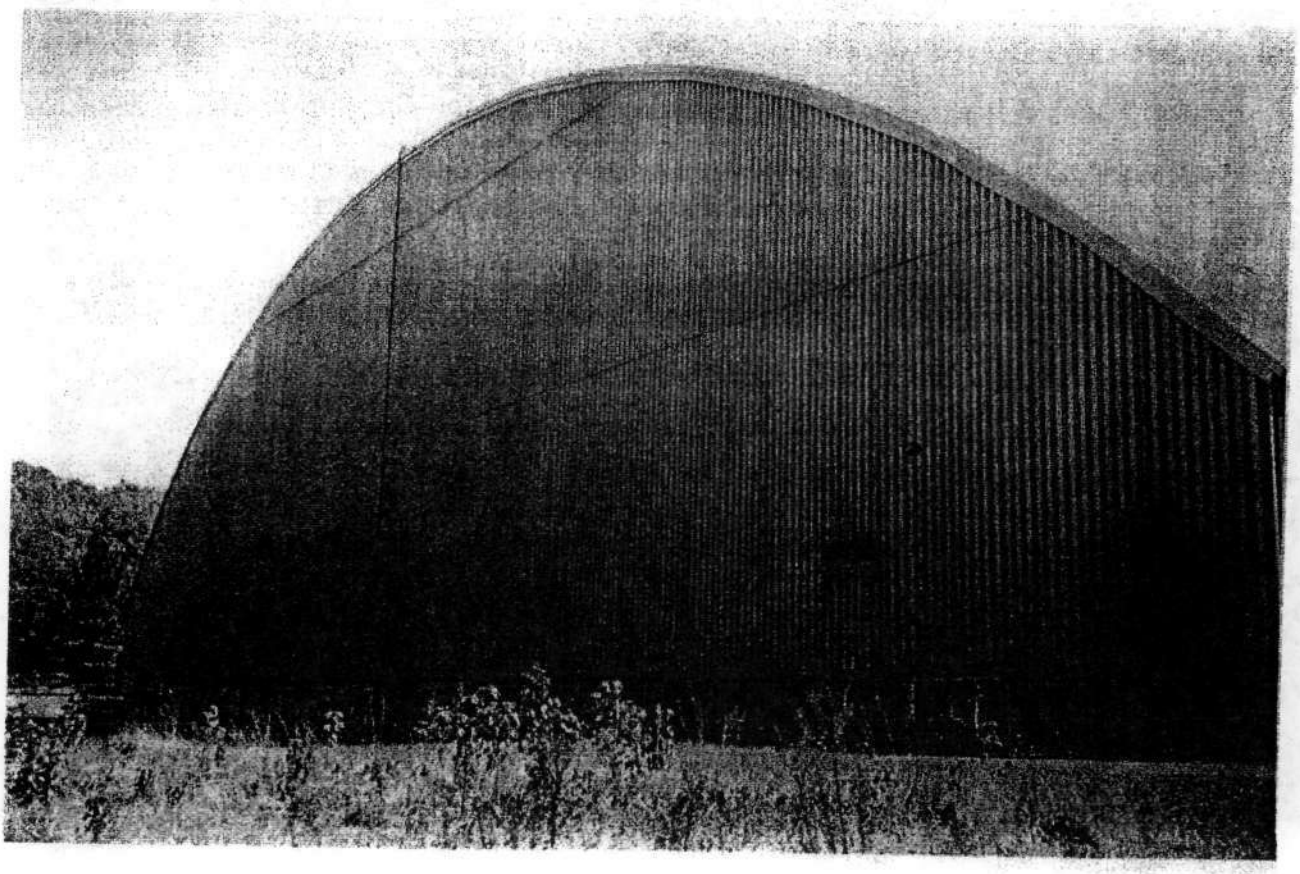

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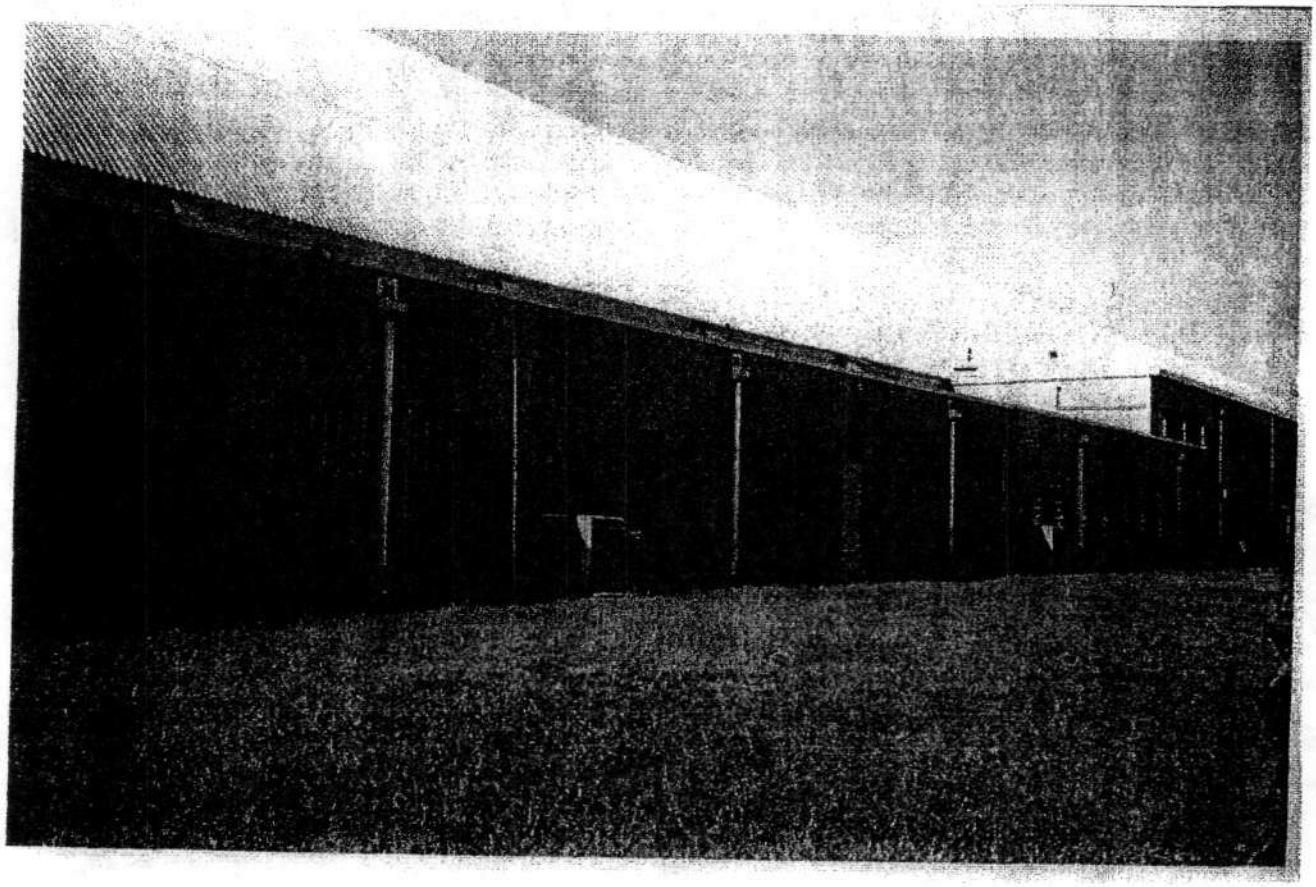

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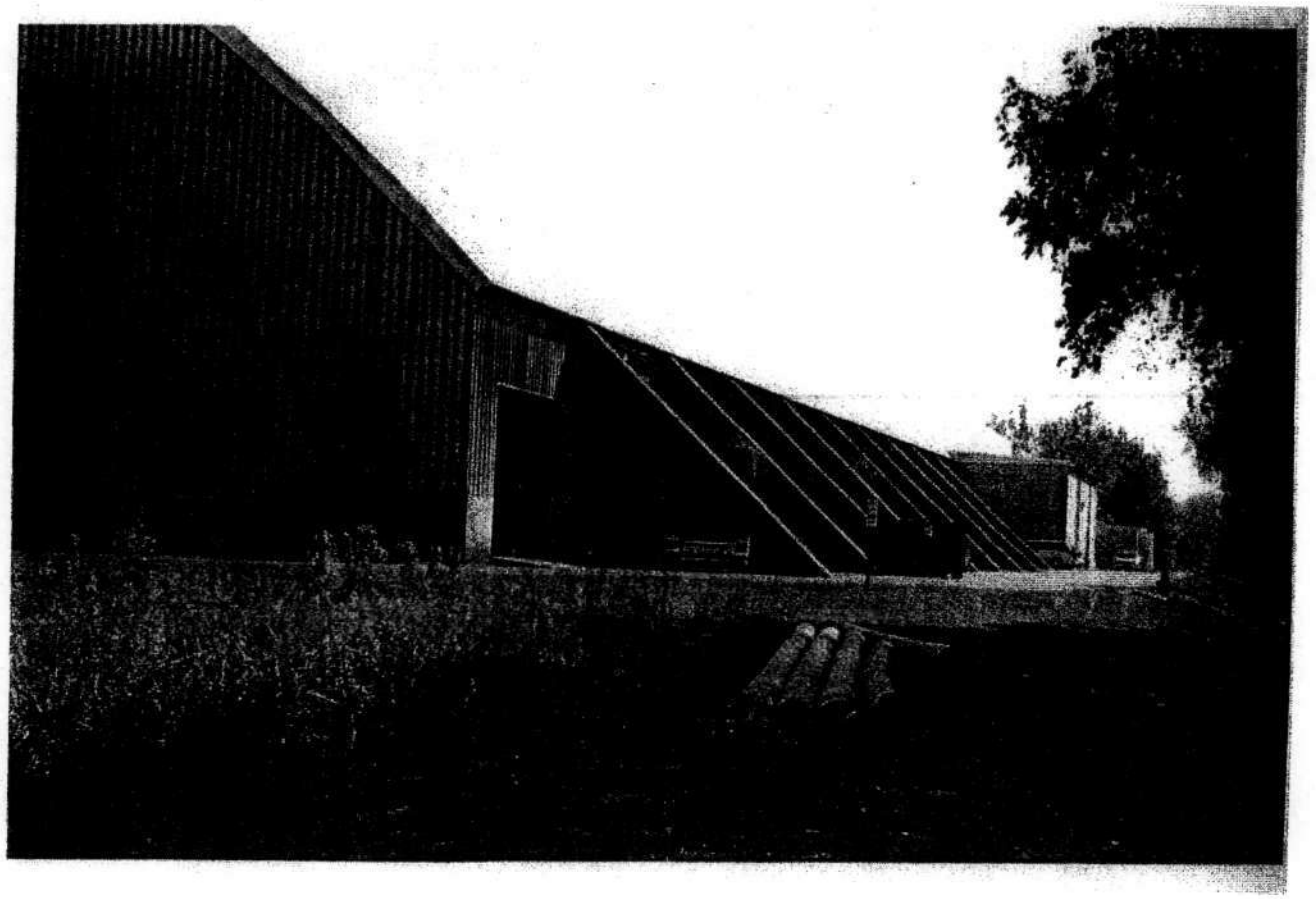

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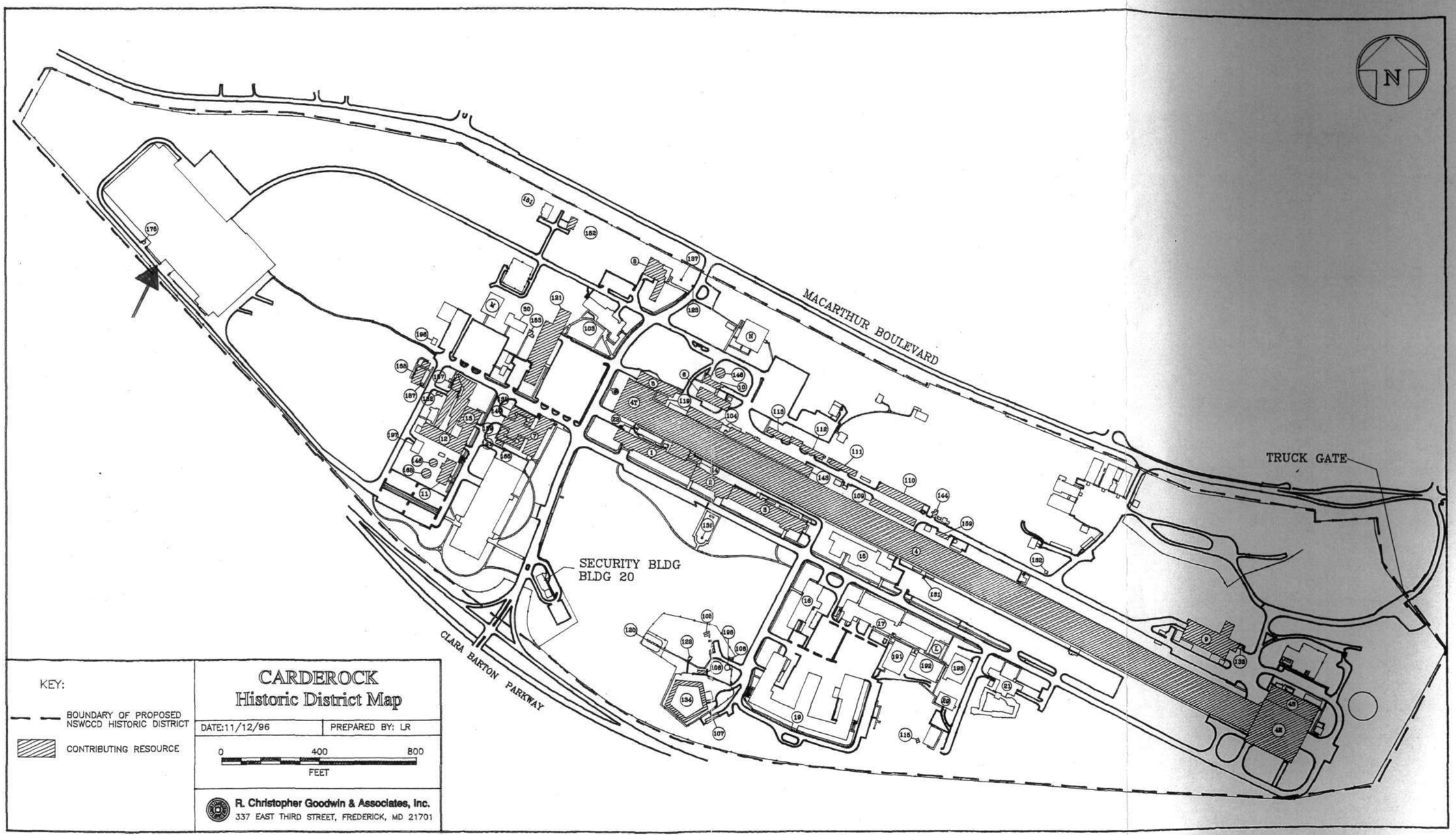
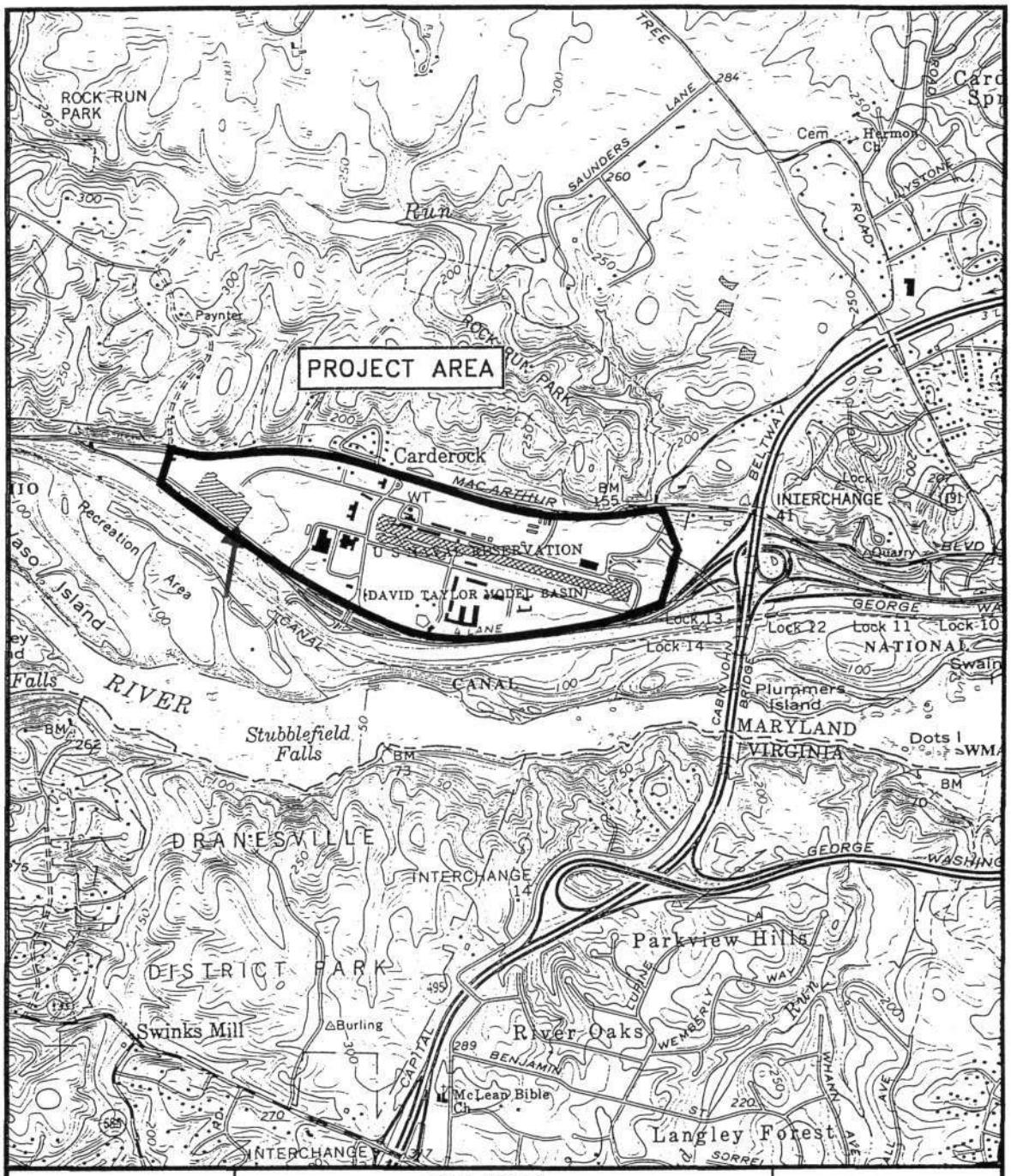


Figure 2. Map of NSWCCD Indicating Locations of Identified Historic Properties

M:29-52-9



R. Christopher Goodwin & Associates, Inc.
337 EAST THIRD STREET, FREDERICK, MD 21701

VIRGINIA
QUADRANGLE LOCATION